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**Mexico Joins the Venture: Joint
Implementation and Greenhouse Gas
Emissions Reduction**

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**Environmental Energy
Technologies Division**

November 1998

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REDUCTION**

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November 1998

**Prepared for the U.S. Environmental Protection Agency
Climate Policy and Program Division
Office of Economics and Environment
Office of Policy, Planning and Evaluation**

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**This work was supported by the U.S. Environmental Protection Agency through the
U.S. Department of Energy under Contract No. DE-AC03-76SF00098**

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ABSTRACT

Joint Implementation (JI) and its pilot phase of Activities Implemented Jointly (AIJ) are envisioned as an economic way of reducing global emissions of greenhouse gases. This paper draws upon the Mexican experience with AIJ to identify Mexican concerns with AIJ/JI and proposed solutions to these.

Three approved Mexican AIJ projects (Ilumex, Scolel Té, and Salicornia) are described in detail. The Ilumex project promotes the use of compact fluorescent lamps in Mexican homes of the States of Jalisco and Nuevo León, to reduce electric demand. Scolel Té is a sustainable forest management project in Chiapas. Salicornia examines the potential for carbon sequestration with a Halophyte-based crop irrigated with saline waters in Sonora.

These three projects are reviewed to clarify the issues and concerns that Mexico has with AIJ and JI and propose measures to deal with them. These initial Mexican AIJ projects show that there is a need for creation of standard project evaluation procedures, and criteria and institutions to oversee project design, selection, and implementation. Further JI development will be facilitated by national and international clarification of key issues such as additionality criteria, carbon-credit sharing, and valuation of non-GHG environmental and/or social benefits and impacts for AIJ projects. Mexico is concerned that JI funding could negatively impact official development assistance or that OECD countries will use JI to avoid taking significant GHG mitigation actions in their own countries. The lack of carbon credit trading in the AIJ stage must be removed to provide useful experience on how to share carbon

credits. National or international guidelines are needed to ensure that a portion of the carbon credits is allocated to Mexico.

1. INTRODUCTION

The concept of joint implementation (JI) was first proposed at the United Nations Conference for the Environment in Rio de Janeiro in 1992, as part of the Framework Convention for Climate Change (FCCC). JI provides a mechanism for industrialized countries to meet their FCCC commitments to limit greenhouse gas (GHG) emissions; one country can invest in GHG emissions reductions in a second country and receive emissions credits from the project. These credits could be used to help meet the investor country's emissions targets. JI also seeks to economically optimize global investment in GHG abatement. Investment will focus on countries where GHG emissions reductions are less costly.

To explore the uncertainties associated with JI, the first FCCC Conference of Parties (COP1) in Berlin in 1995 initiated a pilot-phase open to all parties to the FCCC. Projects initiated during the pilot phase are known as "Activities Implemented Jointly" (AIJ), to differentiate them from mature JI projects (UN-FCCC, 1995; UN-FCCC, 1996). The main purpose of the pilot phase is to learn about and solve the design and implementation of JI. No exchange of carbon credits is permitted under AIJ.¹

Australia, Canada, Costa Rica, Germany, Japan, The Netherlands, Denmark, Finland, Iceland, Norway, Sweden, and the United States have established national JI pilot programs and adopted project acceptance criteria and policies for AIJ. Other countries, such as Chile, El Salvador, Guatemala, Panama, and South Africa are in the planning stages (GCEE, 1996). Mexico has adopted guidelines based on other countries' experiences for JI project evaluation and approval.

¹ In the recent Kyoto Conference of the Parties to the FCCC, a Protocol was adopted that defines the Quantitative Emissions Limitation Objectives of the industrialized countries which overall represent a reduction of more than 5% of their collective emissions referred to the year 1990. This reduction will occur in the period from 2008 to 2012. A project-based mechanism is contemplated among industrialized countries, and between industrialized and developing countries. It is expected that crediting will function after year 2000.

Initial attempts at JI projects in Mexico show that there is a need for creation of standard project evaluation procedures, criteria and institutions to oversee project design, selection, and implementation. It is also critical to clarify additionality criteria, carbon-credit sharing, and valuation of non-GHG environmental and/or social benefits and impacts for AIJ projects.

In 1994, Mexico became a member of the OECD and thus can expect pressure to reach specific GHG emissions reduction goals in the near future. Mexico's carbon dioxide emissions for 1990 have been estimated, using bottom-up methodology, at 444 Tg. Sixty seven percent of emissions come from the energy sector, mainly from the combustion of fossil fuels; the remainder result from land use changes (Gay *et al.*, 1996). The possibility that Mexico may be required to meet GHG reduction commitments in the near future, raises the need to evaluate the possibility of participating in JI projects as either a recipient or investor.

This paper uses case studies in energy and forestry to address Mexico's concerns about JI. The next section provides an overview of AIJ policy and institutions in Mexico today. Section three presents three case studies of approved AIJ projects in Mexico. In Section four, various concerns regarding AIJ in Mexico are analyzed, based on experiences of the three case studies. Whenever possible, solutions to overcome identified problems are offered.

2. MEXICO AND THE JI INITIATIVE

The Mexican government views JI as a means of addressing the problem of global climate change. Mexican enthusiasm for JI is tempered by its concern that Annex I countries might try to use JI to comply with their emissions reductions commitments without carrying out major efforts within their own countries.

Mexico is in the process of establishing a joint implementation office to negotiate and certify carbon emissions reductions; to assess, accept or reject, and monitor JI projects. Meanwhile, the government has set up a coordination group composed of representatives from the Energy Secretariat (Secretaria de Energia, SE), the Environment, Natural Resources and Fisheries

Secretariat (Secretaria del Medio Ambiente, Recursos Naturales y Pesca, SEMARNAP), the National Institute of Ecology of SEMARNAP (Instituto Nacional de Ecologia, INE), the National Meteorological Service (Servicio Meteorologico Nacional, SMN) and the Foreign Affairs Secretariat (Secretaria de Relaciones Exteriores).² The group is responsible for establishing Mexico's preliminary JI program, known as the "Reto Voluntario" (voluntary challenge or RV), and defining its regulations and procedures. The Energy Committee of the SE and the Natural Resources Committee of the SEMARNAP are developing project evaluation criteria and certification mechanisms for energy and forestry projects respectively (INE, 1996; Hernandez, 1996). Accepted projects are entered into a "Registro Voluntario" (voluntary registry).

The main structure of Mexico's AIJ program is shown in Figure 1. AIJ project developers submit their proposals to either the Energy Committee (energy projects), the Natural Resources Committee (land use or forestry projects), or the Ad-Hoc Committee for AIJ/JI (any project). Projects must meet the criteria mentioned below. The Ad-Hoc Committee is responsible for the final recommendation regarding project approval. Once a project is approved, it is entered into the Voluntary Registry.³ The intersecretarial Committee for AIJ has not yet been formed. It will include representation from SEMARNAP, SE, the Secretariat of Foreign Affairs, and the Commerce Secretariat. Once formed, it will provide guidelines for the final approval and acceptance of AIJ projects.

²Secretariats in Mexico are the same as Ministries in Europe and Departments in the USA. Thus, for example, the SE is akin to the Department of Energy in the USA.

³More detailed information on the institutional arrangements can be found at <http://www.northsea.nl/jiq> and in Joint Implementation Quarterly 1997.

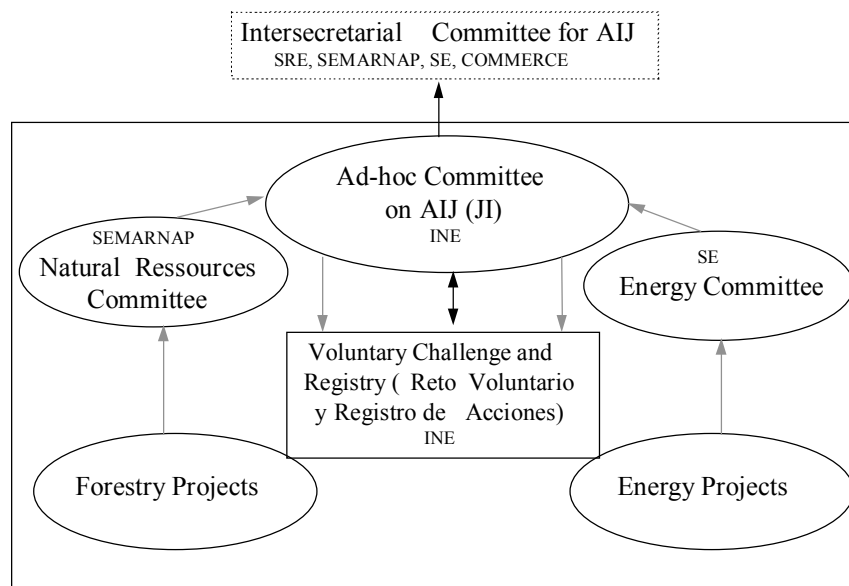


Figure 1. Mexican JI Institutional Framework

Companies that want to participate in the Voluntary Registry submit a signed letter of intent, signed by important officers of both donor and recipient companies, to the AIJ office. Following the letter of intent, an action plan must be submitted that specifies the measures proposed for mitigating GHG emissions.

The AIJ office will also identify resources or information to assist companies in preparing their action plans, including help in establishing baselines and determining methodologies for monitoring and assessment of emissions benefits. Once the action plan is submitted, the participant must submit annual progress reports demonstrating results to be entered in the Voluntary Registry. Ideally these reports should be used as feedback in order to revise the action plan objectives and create new ones.

Preliminary eligibility requirements for the RV state that any Mexican citizen, business, or government entity is eligible to participate in AIJ projects. Citizens, businesses, or governments of countries that have signed or ratified the FCCC are eligible to be foreign partners (INE, 1996). To be considered for the program, project proponents must demonstrate that they will: a) contribute to the socioeconomic and/or material development of

the region or country, and b) advance Mexico's technical self-sufficiency. The government encourages the submission of carbon sequestration projects, cleaner energy generation, and decreased GHG emissions from the industrial and agricultural sectors.

At least twelve proposals had been submitted to the RV program by June 1997 (Table 1). The proposals are extremely varied in content and form. Forest conservation, forest plantations, energy efficiency, fuel substitution and renewable energy are the most common. Six projects are in a very preliminary feasibility stage and do not estimate projected carbon emissions reductions. Four proposals include foreign participation (advice and/or funding); the remaining proposals emanate from Mexican government institutions.

Only two projects have been accepted as official AIJ projects by both Mexico and their investor country. These are "Scolel Té: Carbon Sequestration and Sustainable Forest Management in the State of Chiapas" and "Salicornia: Carbon Sequestration and Halophyte-based Industries in Sonora," which were accepted by the United States Initiative for Joint Implementation (USIJI) program in April, 1997. Ilumex, although not an official AIJ project, can be considered an example of AIJ in Mexico, as it was partly funded by a Norwegian government grant of US\$3 million to study the development of similar projects through JI.

Table 1. Mexican JI Proposals

Name of Proposal	Institutions Responsible	Estimated Project Cost (US \$)	GHG Abatement Cost (\$/tC)	Estimated GHG Reduction
FORESTRY “Scolel-Te: Carbon sequestration and sustainable forest management in the State of Chiapas, Mexico”	Union de Credito Pajal, ECOSUR, Edinburgh University.	\$380,800 (pilot phase 13.5 months) \$ 3 million full scale	2.3 – 11.1 ⁴	330,000 tC/30 yr.
“Salicornia: Carbon Sequestration and Halophyte-based Industries in Sonora, Mexico.”	Salt River Project, Econergy International Corp., Halophyte Enterprises, Genesis,	NA	90 (phase I) 6 (phase II)	22 tC/ha-yr. (after 30 yr) ⁵ 77 tC/ha-yr. (after 100 yr)
“Agroforestry diagnosis of soil and vegetation productivity and carbon sequestration capacity at the Monarch Butterfly Biosphere Reserve”	Instituto Nacional de Investigación Forestal Aplicada (INIFAP), Instituto Nacional de Ecología (INE), Instituto Nacional Indigenista (INI).	\$98,961 (for feasibility stage)	NA	NA
“Commercial development of the tropical rain forest in Campeche on a sustainable basis”	Silvicultura del Ejido Champoton	\$1,600,000 (for feasibility stage)	NA	NA
“Carbon capture: Community forestry Sierra Norte de Oaxaca”	SEMARNAP, Mexican Civilian Council for Sustainable Forestry, Ixeto and Uzachi Community	\$113,783 (funding request)	1.7	2,058 MtC

⁴In the proposal, the project developer provided estimated costs for agroforestry and plantation projects ranging from US\$2.3 tC/ha (live fence, i.e., tree windbreaks) to US\$4 tC/ha (enriched fallow) for the Tzeltal region, and US\$2.5 tC/ha (live fence) to US\$11.1 tC/ha (plantation) for the Tojolobal region. These costs estimates are based upon an intermediate level of production intensity and a discount rate of 5%. By raising the discount rate to 10%, these costs estimates shift to US\$1.8 tC/ha to US\$2.7 tC/ha for the Tzeltal region, and US\$1.5 tC/ha to US\$8.9 tC/ha for the Tojolobal region, respectively.

⁵Net carbon storage value for Phase I of the project (30ha) = 660 tC.

“International Model Forest Program, Chihuahua”	Canadian Model Forest, SEMARNAP	N/A	NA	N/A
Name of Proposal	Institutions Responsible	Estimated Project Cost (US \$)	GHG abatement cost (\$/tC)	Estimated GHG Reduction
<u>ENERGY</u> High-Efficiency Lighting Pilot (ILUMEX)	Comisión Federal de Electricidad (CFE), Global Environment Facility (GEF), Kingdom of Norway	23,000,000	8.6	198308 tC ⁶
“Burners and fuel change in the brick-ovens in San Pedro Cholula Puebla.”	NA	NA	NA	NA
“150 MW Wind Farm in La Ventosa, Oaxaca region”	Instituto de Investigaciones Electricas (IIE)	NA	NA	600 MtC/yr.
“Rio Lerma hydrological resource and electricity generation”	ENTEC, New World Power Corporation, TEISA	NA	NA	NA
“Renewable Energy for the Natividad and Cedros Islands in Baja California”	Universidad Autonoma Metropolitana	\$23,850 (for feasibility stage)	NA	7414 tons/yr.
“Photovoltaic/wind Hybrid Systems for Village Power or Minigrid Power Supplies”	SIMITEC	\$1,000,000 (for feasibility stage)	NA	N/A

N/A: Not Available

⁶ The total number of estimated tons of carbon dioxide equivalent reductions from both CO₂ and methane over the lifetime of the project is 727,130.

3. CASE STUDIES

Including the ILUMEX project, by June 1997, there were three AIJ projects under implementation in Mexico. We briefly describe them below as background for the analysis of the JI issues raised in the section 4.

3.1 High-Efficiency Lighting Pilot Project: ILUMEX⁷

ILUMEX is the first large-scale, energy efficiency demand-side management (DSM) project in a developing country.⁸ The project funding totals US\$23 million (Table 2).

Table 2. ILUMEX Funding

	US \$
Source of funds	Million
Commission Federal de Electricidad (CFE) (Funds)	10
Global Environment Facility (GEF) (Grant)	10
Kingdom of Norway (Grant)	3
Total Funds	23

The project's goal is to demonstrate the technical and financial feasibility of simultaneously reducing GHG emissions and local environmental pollution through widespread installation of high-efficiency lighting.

Initially, ILUMEX planned to replace 1.7 million incandescent light bulbs with compact fluorescent (CFLs) in homes in the Mexican cities of Guadalajara and Monterrey. The project has since been expanded because of its success.

⁷ Information comes from ILUMEX project report 1997, unless otherwise noted.

⁸ DSM refers to utility programs to reduce the demand for electricity.

CFLs require only about 25% of the energy needed by incandescent bulbs to produce the same level of lighting, and they last up to thirteen times longer (Anderson, 1995).

The benefits of the project will be shared with participants through a rebate of 63% (on average) of the total cost of the CFL (including overhead costs). Participants pay for CFLs either in cash or through a deferred payment plan, which allows the cost to be charged to their electricity bills over a period of up to 24 months. CFLs are being sold at the offices of the Federal Electricity Commission (Comision Federal de Electricidad or CFE).

Special technical specifications were drawn up to ensure that the CFLs operate properly and last their projected lifetime despite the significant voltage variations in the Mexican power system. CFL performance guarantees are provided for both the customer and CFE.

To facilitate cost/benefits accounting and administration, a local trust fund was set up in each city. The fund provides transparent and separate accounting of project costs. The project is centrally managed at CFE's Mexico City offices.

As shown in Table 3, the ILUMEX project benefits individual users and society in general.

Table 3. ILUMEX Project: Non-GHG Benefits

- i) Project participants enjoy a comparable or higher lighting level at reduced cost. In early surveys, about 2/3 of customers expressed the program as being very good or excellent (Vargas, 1996). Net estimated benefits to consumers (bill savings - CFL costs) are US\$ 16.8 million (INE, 1997).
 - ii) Society and CFE can postpone investments in about 100 MW of new generation capacity and save about 169 GWh annually.
 - iii) An estimated total 940 GWh of electricity sold by CFE at a loss, will be avoided. The avoided cost of this electricity has been estimated by CFE at US\$ 44.4 million (1993\$). Customers will save an estimated US\$ 26.85 million in electric bills.
 - iv) Emissions of pollutants are reduced (see Table 4).
 - v) Annual power plant water use is reduced by about 608,000 cubic meters (Vargas, 1996).
 - vi) The project should have an impact on raising the awareness of the general public regarding energy conservation.
-

The ILUMEX project will benefit the environment by reducing emissions of several air pollutants from electric power plants (Table 4) and saving water that would be used to cool power plants, particularly in the arid region near Monterrey.

Table 4. Major ILUMEX Emissions Reductions

Compound	Total emissions reductions (ton)⁹
Carbon Dioxide (CO ₂)	726,675
Methane (CH ₄)	19
Nitrogen Oxides (Nox)	1,982
Sulfur Oxides (SO _x)	10,986
Particulates	5,363
Carbon Monoxide (CO)	188
Hydrocarbons (HC)	746

Source: INE, 1997.

The major obstacles to ILUMEX were financial and, to a lesser degree, institutional. CFE had to first persuade the GEF to grant money and the World Bank to loan money for the project. CFE then had to persuade the Mexican Finance Secretariat to accept the World Bank loan because a governmental mandate at that time restricted funding in foreign currencies. The project also entailed a paradigm shift for some CFE managers, the Finance Secretariat and World Bank staff regarding the validity of investing in DSM to reduce electricity demand and corresponding generation capacity (Friedmann, 1996).

By April 1997, more than 1.3 million CFLs had been sold (Vargas, 1996). In view of the high rate of sales --especially impressive because they occurred while Mexico was in a severe economic depression--, CFE has purchased another half million CFLs and expanded the Ilumex program to cover all of the states of Jalisco and Nuevo Leon. Other residential CFL projects under way will place six million CFLs in Mexican homes by the year 2000 (Friedmann, 1996).

⁹ The environmental benefits of the project were originally estimated by consultants as part of the project's feasibility study. These estimates have been revised by UNAM, CFE and INE based on the fuel used at the power plants serving the two cities during 1996 and results of preliminary monitoring of average daily use of the CFLs.

Ilumex is in its final stages of implementation. Evaluation of Ilumex accomplishments is still ongoing.

3.2. Scolel Té: Carbon Sequestration and Sustainable Forest Management in the State of Chiapas, Mexico.¹⁰

This carbon sequestration project proposes to preserve existing forest and help to develop small, forest-based enterprises in two ecoregions with indigenous populations (Table 5). The project expects to initially develop 1,200 hectares (ha) of agroforestry and another 1,000 ha of natural forest management within an area of approximately 13,000 hectares (ha) where about 3,500 people live. The estimated amount of carbon that could be sequestered varies between 47 and 237 tC/ha, with an average of 126 tC/ha.

Table 5. Scolel Té Project Costs and Expected Savings

Total cost over 3 years	3.3 million (US\$)
Total area forested/conserved	13,289 (ha)
Carbon sequestered after 30 yr.	330,000 (tC)
Carbon emitted without project (30 yr.)	600,000 (tC)
Cost of Carbon sequestration	2.3-11.1 (US\$/tC)

Individual farmers or forest user groups will receive a 140 US\$/ha planting grant in year zero and an annuity of US\$ 70 for 18 years, from year 1. Additionally, technical assistance will be provided in the planning and design of forestry and agroforestry systems, the construction of nurseries and propagation facilities, the collection of seed, and the organization of activities. Baseline studies will be conducted around the time of planting and periodic monitoring will continue up to 18 years. Twenty-seven years of benefits are expected from the project after a three-year start-up period.

¹⁰ Information taken from De Jong et al., 1995 and Tipper et al., 1996.

The project will be executed by the Union de Credito Pajal (a local indigenous farmers' organization) with monitoring conducted by El Colegio de la Frontera Sur (ECOSUR, a local academic research center). The University of Edinburgh will provide community forestry planning guidelines, internal monitoring systems and on site tree improvement and propagation techniques.

As shown in Table 6, the project is expected to yield both ecological and economic benefits. It is important to note that these benefits have not been quantified and require further study to allow for a complete analysis of project benefits and costs. The main difficulties to their quantification are how to define the boundaries of analysis, and how to correctly value these benefits in view of the incomplete knowledge of the ecosystems. Work will also be required to assess both positive and negative “leakage” of sequestration benefits.

Table 6. Scolel Té Project: Non-GHG Benefits

- i) Improvement of conservation prospects for important areas of a cloud forest with endemic species
 - ii) Conservation of intra-species genetic diversity of valuable tree species.
 - iii) Reduction of migration from the project areas to the Lacandon
“agriculture-forest frontier
 - iv) Improvement of women's welfare.
 - v) Enhancement of local economic development by stimulating
enterprises forest-based
-

3.3 Salicornia Project. Carbon Sequestration and Halophyte-based Industries in Sonora¹¹

This is a demonstration project in Sonora, Mexico, cultivating *Salicornia bigelovii*, a halophyte plant that can be irrigated with sea water. Two phases are proposed (Table 7).

¹¹ Project information was provided by Candace Dunn at Eenergy International Corporation, unless otherwise noted.

During the first phase, 30 hectares will be cultivated. During the second phase, the cultivated area will expand to 50,000 hectares. Phase 1, has been approved by USIJI. The benefits estimated for Phase 2 will occur only if it is fully funded and implemented as described in the proposal. Phase 1 carbon emissions benefits are only claimed for soil sequestration.

Table 7. Salicornia Project: Costs and Benefits

Project cultivation area (Phase I)	30 (ha)
Project cultivation area (Phase II)	50,000 (ha)
30-year equilibrium carbon storage in soils	22 (tC/ha-yr)
100-year equilibrium carbon storage in soils	77 (tC/ha-yr)
Net cost of carbon stored (Phase I)	90 (US\$/tonC)
Net cost of carbon stored (Phase II)	6 (US\$/tonC)

The net amount of carbon emissions avoided will depend on how much emissions result from growing the plants (fuel used for water pumping and harvesting, and agricultural inputs) and how the products of the plant will be used. Currently, diesel is used to run pumps for irrigation with estimated emissions of 0.84 tC/ha-yr; a significant amount as net sequestration in soils is estimated as initially only being 2.5 tC/ha-yr. In Phase 2, improved irrigation systems (cement piping, energy efficient pumps, etc.) become economically viable. The improved irrigation systems are expected to reduce emissions to only 0.28 t C/ha-yr; about double that of typical irrigation schemes where non-saline water is used. The increased emissions are due to the need to use larger amounts of saline water to prevent soil salinity problems. An alternative that has not been considered by the project promoters is using renewable-energy technologies for water pumping.

Phase 1 will demonstrate Salicornia cultivation potential in Sonora, evaluate Salicornia as a source of several commercially valuable products, and investigate carbon sequestration issues including carbon storage in soils and bulk biomass storage from the cultivation of annual crops.

The main products of the project are straw and edible salicornia tips and oil (Table 8). The straw is expected to be turned into particle-board for residential buildings, where the carbon would be sequestered. Yet, such sequestration is not assured. The entry of salicornia straw to wood markets could lower the price for wood, reducing the incentive for forest plantations. Alternatively, it could also reduce deforestation. There is a risk that some of the straw could end up in the paper-products markets if these become more profitable, in which case less carbon emissions would be avoided. It will be important to carefully determine the real carbon emissions avoided by this project before it is expanded to the second phase.

Salicornia production can also benefit Mexico by reducing imports and creating jobs. The Salicornia oil can help reduce the significant Mexican imports of 2.5 million tons of oilseed. Project promoters estimate that each additional 10 hectares of Salicornia production could create three to seven new jobs (JIQ, 1997).

Table 8. Salicornia Project: Non GHG Benefits

- | | |
|------|---|
| i) | Food products like cooking oil and “sea asparagus”, a delicacy that sells in Europe for US\$ 20 per pound |
| ii) | Biomass and oil-additive fuel for power generation and combustion engines, respectively |
| iii) | Fiber-based material for particle-board manufacturing |
| iv) | Use of Salicornia seed (42% protein) to supplement livestock feed. |
-

4. CONCERNS ABOUT JI PROJECTS IN MEXICO

Major concerns about JI have emerged in international forums and from the definition, design, presentation, and implementation of AIJ projects. In this section we discuss whether such concerns have been important in Mexico, based on the AIJ projects described previously. Some concerns point to institutional problems that need to be addressed; others indicate the need to further evaluate Mexico’s capacity to profit from JI as a recipient country.

Mexico is concerned that current Annex I countries will try to use JI to comply with most of their commitments on GHG emissions reductions. Mexico would like to see these countries take more GHG mitigation actions within their own countries. An international standard limiting the amount of emissions credited to any given country with JI might be useful.

In Mexico, project developers have shown more interest in investing in energy sector projects and less so, in land use projects. Mexico prefers to use JI for land use projects where either ODA or private sector investment are harder to obtain. JI proposals for energy sector projects that could be financed by other means are discouraged. For the energy sector, JI seems more promising for financing demand-side actions, rural electrification, and with the recent restructuring laws, small generation and cogeneration.¹² The significant uncertainties involved in large-scale energy sector investments have become an obstacle to JI financing. In the forestry sector, there are more opportunities for JI investment. The main unresolved issue in forestry sector projects is the social organization required to ensure the global environmental service of carbon savings and crediting.

4.1 Criteria for Project Approval

4.1.1 “Additionality” Criteria

There are two main “additionality” criteria for JI projects. One establishes that the measures undertaken by a project to reduce GHG emissions are in addition to what would have occurred without the project. The other definition of additionality requires that the financing of projects be in addition to current official foreign development funding.

Because of its dual meaning, additionality is a confusing and complicated term. Because additionality is a basic criterion for all JI projects it needs to be clearly defined at the international level as a JI project characteristic and at the national level in each country’s guidelines and criteria.

¹² Before the legal modifications of 1992, it was the sole purview of the two public utilities to generate, transmit, and distribute electricity. Now individuals are allowed to generate electricity, with the public utilities still being the sole transmitters and distributors.

4.1.2 Difficulty in Estimating the Additional GHG Emissions

Although all three Mexican case-study projects seem to fulfill the additionality criterion, emissions reductions were hard to determine accurately. Each project established a baseline and then estimated the emissions reduction in relation to that baseline. Any of the multiple assumptions required to estimate GHG emissions reductions could be incorrect. For example in Ilumex, in addition to the assumptions made for elaborating the baseline scenario, all the following assumptions were required to estimate the emissions that would be avoided: the number of incandescent bulbs that would be replaced, the wattage saved per bulb replaced, the hours and schedule of use of each bulb, the transmission and distribution losses of the grid, the power plants whose electric generation would be curtailed due to the reduced electricity demand, the fuels that would not be burned to generate power, and the emissions normally accruing from the burning of such fuels. Any of these assumptions could be wrong or could change during the project's lifetime.

The baseline scenario and assumptions used to determine emissions savings scenarios, may need to be revised in order to accurately estimate carbon credits for proper accounting of emissions credits, their distribution among donors and recipients, and for project evaluation. Such revisions should be undertaken by neutral, third parties. The annual RV reporting requirement presents an opportunity to reevaluate GHG emissions credits with the project developer.

4.1.3 Additionality of Funds

Government agencies' financial support of AIJ can make it difficult to determine financial additionality for a project. In such situations, it can be hard to differentiate JI funding from other official development funding coming from the same agencies. Mexico is concerned that official development assistance (ODA) could be compromised by JI funding. The RV requires that JI project implementation funding be non-ODA, as occurred in Scolel Té and Ilumex (see below). ODA funding for JI projects is permitted for project preparation and to support JI institutional infrastructure.

Financial additionality is an important criterion for countries like Mexico that are already

receiving external funding to create and support environmental and socioeconomic programs. Clarifying the definition of additionality will help ensure that financial aid from international sources for environmental and social welfare projects is not reduced as a consequence of JI.

The Scolec Té forestry project demonstrates the difficulty of determining additionality of funding. Official development assistance from England is involved in the project's prefeasibility research that seeks to establish land-use patterns and potential local impacts of the project. Mexican AIJ evaluators determined that the project meets the additionality criterion because no ODA funds are used in project implementation, where the actual carbon benefits occur.

Initial funding for project implementation came from the Federation Internationale de L'Automobile (FIA), an international association of automobile clubs. FIA will provide US\$50,000/yr for the first three years. This funding will pay for planting and carbon sequestration activities on the first 30-50 hectares.¹³ In addition, the International Federation for Carbon Sequestration (an association established by FIA and AIT, another motoring organization) will manage a fund through which other interested parties may invest in the project (Greenhouse Issues, 1997b).

In Salicornia additionality of funding was not an issue. In Ilumex initial funding did not require such compliance as it was not an AIJ project. Original seed money for Ilumex prefeasibility was ODA (from USAID). Mexico has, in two of the three case-studies analyzed here, accepted AIJ projects with ODA funding as long as it was not used for project implementation.

4.1.3 Sharing of Carbon Credits

JI permits the sharing of "carbon credits" or tons of carbon reduced by project between investors and recipient countries. These carbon credits are the main incentive for investors to undertake JI projects (De Lucia, 1996).

¹³ Information provided by University of Edinburgh on February 13, 1997 to Ken Andrasko, USIJI Secretariat.

Under AIJ, no carbon credit sharing is allowed. Mexico's chief concerns with carbon credit sharing and proposed solutions are summarized in Table 9.

Table 9. Mexican Concerns with Carbon Credit Sharing

Concern	Proposed solution
Lack of carbon credit sharing in AIJ limits experience that can be gleamed on this crucial aspect for JI success	Allow proto-carbon credit sharing in AIJ as Costa Rica's Certifiable Tradable Offsets to prepare way for implementation of the Kyoto Protocol.
Unknown value of carbon credits makes difficult project evaluation, and complicates negotiations to establish how to share these between donors and recipients.	Let a carbon credit market determine their value or begin with national or international values (e.g., GEF's acceptable "unit abate-ment cost") while such a market is developed.
Avoid all carbon credits leaving country; to ensure credits remain future Mexican GHG commitments.	Promulgate national or international guideline or standard that puts a cap on the foreign carbon credit share.
Donors threats to go elsewhere unless given higher share of carbon credits	Prepare "quality" projects whose soundness makes them attractive to investors. Pass and enforce international standards specifying foreign share of carbon credits.
Lack of awareness among of value of carbon credits and/or weak bargaining position vis-à-vis donors.	National education campaigns on the value of carbon credits and the JI concept. National guidelines for JI project approval stipulate minimum credit sharing terms.

The lack of international or national guidelines on how to share the carbon credits was a major issue in the Salicornia project. Donors initially proposed that they receive 95 percent of the carbon credits. The Mexican recipients initially agreed to this distribution because of

their lack of knowledge and awareness of the value of the carbon credits. The Reto Voluntario program did not accept this skewed distribution of carbon credit sharing that could have set a precedent for future JI projects. Credit sharing was not contemplated in the Scolel Té and Ilumex projects and thus, was not an issue in those projects.

Current Mexican concerns (Table 9) about carbon credit sharing can be addressed in the following ways:

(a) Experiment with carbon trading systems at the national or multilateral level. Although actual crediting is not allowed for AIJ, participants could submit their projects as hypothetical cases to test various carbon credit systems. Various projects and countries are already experimenting with different systems. In the Scolel Té project, investors can buy “prototype carbon credits” from a local trust fund (*Greenhouse Issues*, 1997a). Costa Rica has proposed establishing a national carbon fund to facilitate JI investments; this fund would receive investment money and pass it on to JI project developers. In exchange for their investment, investors would receive credits in the form of Certifiable Tradable Offsets (CTOs). The carbon benefits from the project are defined on a base year, and permanently monitored. (*JI Quarterly*, June 1996). These carbon trading systems should be carefully studied for effectiveness and replicability under the Protocol of the Kyoto Conference of Parties to the FCCC.

(b) Create an international standard or market for defining the value of carbon on a multilateral level, so that parties involved in JI projects can negotiate the distribution of carbon credits for individual projects. Can begin by using the Global Environment Facility’s (GEF) acceptable “unit abatement cost” (the cost per unit of GHG emissions abated or sequestered) (GEF, 1996). Carbon emissions could be valued in a similar fashion. Once a carbon valuation standard is accepted, carbon benefits can be quantified and included as an integral part of a project’s feasibility analyses to define investment priorities. International standards on carbon emissions valuation could thus deal with this issue while carbon emissions trading markets are established. The markets would ultimately determine the value of carbon credits.

(c) Mexico should develop national guidelines/standards for sharing carbon credits that

provide an incentive to foreign investors and also allow Mexico to apply credits toward its own future emissions reductions account. This is of particular importance because Mexico joined the OECD in 1994 and may therefore be required to reduce its own emissions in the near future. One method by which Mexico could retain some credits from JI projects would be negotiating with the investor a cap on the exportable credits for every transaction.

(d) The threat of investors going elsewhere can be ameliorated by ensuring that Mexican projects are “quality” products; i.e., ones where the carbon emissions reductions are quite certain due to the groundwork done beforehand. Also, can establish international guidelines/regulations on the sharing of carbon credits under the Kyoto Protocol. Mexico plans to contribute its experience to this effort.

(e) Mexico needs to educate possible project recipients on the concept of JI and the value of carbon credits to strengthen these parties negotiating stance vis-à-vis donors. Minimum national guidelines on carbon credit sharing can be enacted to further ensure that negotiated agreements are not biased in favor of project investors.

4.1.5 Importance of Non-GHG Benefits to JI Project Attractiveness

The non-GHG benefits of JI projects are probably the most compelling reasons for recipient countries to accept these projects. This is clearly the case in Mexico, where all three projects described had significant potential non-GHG benefits. Developing countries see JI as a source of additional private foreign investment funds that may otherwise be unavailable and may provide benefits in addition to preventing global climate change. To the degree that the non-GHG benefits are significant, the project will have greater chances of permanence. For example, if a forestry project conserves a biosphere, it can lead to an increase in eco-tourism, providing further incentive for locals to guard the welfare of the forest.

The importance of non-GHG benefits must be evaluated by the JI offices in recipient countries. In Mexico, projects that help promote better living conditions are desirable. Thus, projects that have positive secondary socioeconomic and local environmental effects are of great interest.

Many JI projects occur in rural areas (Table 1) where there is a need for more employment to

reduce migration to cities or foreign countries and to provide local income. The Scolel Té forestry and Sonora salicornia projects could have a significant impact on improving local socioeconomic conditions. Ilumex, helps create jobs in urban centers by promoting the manufacture of CFLs and by producing savings that can be invested in other productive activities.

For ILUMEX, the societal internal rate of return (IRR) exceeds 56% (Ilumex 1994). For CFE alone, the IRR exceeds 32%, and for most consumers the minimum IRR is more than 100%. From these figures, project designers conclude that the Ilumex project could have significant economic benefits for participants (Table 3).

Table 8 shows the main benefits expected from the Sonora project. Salicornia is an ideal crop for desert coastal zone development and revitalization; it can also help reclaim saline desert areas. Thus, salicornia plant is a potential global agricultural resource. Added benefits are its potential to remove and store salt and heavy metals from waste water and to reduce salinity of drainage water in large-scale irrigation schemes as salicornia can be irrigated with sea water. The actual cost of new irrigation in this area are about \$10,000/ha. Using sea water irrigation could reduce this cost to about \$3,000/ha. Promoters of the salicornia project claim that each additional 10 hectares of salicornia production will result in three to seven new jobs.

Scolel Té forestry project developers claim local ecological benefits from forest conservation, and economic benefits accruing from the investments that lead to improved local economic development and reduced migration from rural areas (Table 6). It is not clear whether these benefits will continue when the project is over.

The significant non-GHG benefits of the three AIJ projects helped project promoters overcome critics concerns and gained their acceptance to the Reto Voluntario program. In countries like Mexico, climate change is not the most compelling issue for garnering project support. In Ilumex for example, parts of CFE, the Mexican Finance Secretariat, and the World Bank, were reticent to carry out the project. It was the significant non-GHG benefits that overcame their initial skepticism. It is thus important for project promoters and

developers to quantify the non-GHG benefits as accurately as possible to overcome the opposition of detractors of climate change.

4.2 Risks

In-depth risk analysis should be an intrinsic component of project evaluation. An investor's decision to fund or not to fund a project depends partly on sensitivity analyses of possible changes in relevant macroeconomic variables, especially for long-term and/or high-cost projects, as well as on the risks associated with the project concept itself. It is also very important to define the responsibilities for the risks of unexpected impacts and how these will be allocated among the parties. For JI projects in developing countries, these elements of risk need to be evaluated carefully.

4.2.1 Macroeconomic Risks

Macroeconomic conditions cannot be predicted with certainty anywhere, and certainly less so in developing countries.

The recent, unexpected economic depression in Mexico took investors by surprise, and could have significantly affected the AIJ projects. The Scolel-Té and Salicornia projects were not affected due to their initial pilot-scale and low foreign currency requirements. If these two projects are expanded to full-scale implementation, provisions will need to be made to deal with the risk of changing macroeconomic conditions.

Illumex, which could have been significantly impacted, demonstrates how the risk of macroeconomic disruptions can be ameliorated. Although the financial support of Illumex was assured before the economic crisis that ensued after the December, 1994 devaluation of the peso, its success still depended on consumers purchasing and using the CFLS. The availability of foreign funds (particularly the US\$ 13 million GEF and Norwegian government grant) made it possible to purchase the original amount of CFLs while the peso was devalued almost 100 percent. The grant portion of funding also allowed Illumex to maintain the subsidy in the price of the CFLs and continue to offer the credit-financing-sales

scheme. Without this 60% subsidy in the price of the CFL and availability of low-interest financing, it is doubtful that CFL sales would have met expectations. Indeed, sales among lower income customers were less than hoped for. The devaluation of the peso in December of 1994 and the ensuing inflation and job losses, led to a significant fall in consumer purchasing power and confidence by the time Ilumex began to offer the CFLs in April of 1995. Future projects will probably entail similar subsidies and financing schemes until consumers regain their lost purchasing power, which could reach its 1994 level at the end of the century (Stevenson, 1996).

In recent years, changes in the Mexican economy have transformed the country from a cheap labor market to an emerging consumer market and then back to a cheap labor market (Schriner, 1996). The current cheap labor market bodes well for the Chiapas and Sonora projects, which rely heavily on cheap labor. However, the current depressed consumer market is detrimental to projects such as Ilumex that require consumer purchases.

4.2.2 “New Activities” Risks

Because JI projects involve energy efficiency, renewables, or sustainably managed forests, JI investors must consider the risks associated with these new endeavors, where there is less previous experience and infrastructure to draw upon.

Ilumex, though not initiated as a JI project, is a good example of the risks of new activities. Despite an economic rate of return that would usually suffice to attract private investors, the project had several high-risk elements, including technological uncertainties, CFE's and the World Bank's lack of familiarity with DSM projects, and consumer reluctance to purchase comparatively unknown and high-cost CFLs. Without the foreign funding and experience with similar projects elsewhere, Ilumex would likely not have taken place due to the unfamiliarity of locals with its potential benefits because of its newness and the risks associated with it. Indeed, a private bank declined to lend money to CFE in 1990 for a five million CFL project, citing that the lack of developing country experiences with CFL projects made the loan too risky (Friedmann, 1996).

However, the ILUMEX project also points to the beneficial spillover from risky projects. Focusing investments on the most technologically advanced or innovative projects will reduce the barriers to investing in similar projects in the future. Such projects once successful may become attractive to future domestic private sector investors, increasing the overall level of technology being used under JI. ILUMEX's success has led to its expansion in Mexico and has provided a base of experience for similar CFL projects elsewhere.

To some degree, the GEF has already paved the way for establishing funding criteria that support innovative, risky projects. These criteria include replicability of a project, removal of barriers, and reduction in costs of promising technologies for future investment. Projects that do not have these "long-term advantages" are only considered for funding if they are highly cost effective -- with an incremental cost per ton of carbon saved of US\$10 or less. Projects that have long-term advantages do not have to meet this cost effectiveness limit (GEF, 1996).

4.2.3 Long-term Project Risks

It is difficult to predict project duration and thus the sustainability of carbon savings from JI projects. The longer the planned life of a project is, the greater the uncertainties become. Forestry projects typically have a life span of several decades, like the 30-year Scolel Té project.

For example, Mexico's land tenure legislation has already changed in ways that may affect the Scolel Té project in the long run. Prior to 1992, ejido and communal lands could not be sold—they were owned communally in perpetuity. In 1992, legislation allowed the ejido or communal assembly to sell its land. If a communal project changes hands, its future becomes uncertain. However, if projects are undertaken to improve the standard of living for the community, for example by reducing degraded land or increasing agricultural productivity, community members may be more willing to remain on and to work their land, which will enhance the AIJ project's continuity.

4.2.4 The Risk of Dumping Old Technology

JI projects could give developing countries the opportunity to obtain new technology at low

cost (Younger, 1996), while offering investors the opportunity to field test the technology. The Salicornia project is a good example of field testing a new concept; being a demonstration project to evaluate cultivation possibilities and commercial uses of a previously uncultivated crop.

Part of the allure of JI is its potential to increase the transfer and co-development of technologies that reduce local and/or global environmental impacts. However, Mexico is concerned about the potential for investors using JI projects as a way to “dump” obsolete technologies.

Technology dumping was not a problem in the three case study projects examined in this paper. The Ilumex project introduced CFLs, an energy-saving technology in Mexico. Stringent technical specifications were written into the CFL bid documents to ensure that the CFLs used in the project would be an improvement on the best available technology at the time. In addition, at least half of the CFLs being sold are manufactured and assembled in Mexico. This creates demand for equipment that goes into the CFLs, such as glass tubes, electronics, ballasts, and casings, which in turn creates employment and furthers technology transfer.

Another risk associated with JI projects is that inadequate or inappropriate technologies could be imported to recipient countries. This problem could arise, for example, in agroforestry projects where the selection of species and the crop timbering process or machinery depend on local biophysical, social, cultural and organizational factors (Lemaster, 1995). The Scolel Té project minimized this risk by including local communities and their agroforestry traditions in the project design process. In Ilumex, the CFLs were required to incorporate technology that would protect them from the large voltage fluctuations typical in the Mexican grid.

The Mexican experience shows that the risk of technological dumping of old, obsolete, or inappropriate technology can be averted by careful evaluation of project proposals and technological specifications. It behooves recipient countries to pay attention to this issue, as

this will also improve the success of the ensuing projects.

Special conditions must be created to promote investments in technology. Reducing duties and taxes on capital goods as well as shifting subsidies from conventional energy technologies to sustainable alternatives are viable strategies for improving Mexican living conditions while preserving the environment.

JI will be judged in part by its ability to promote clean technologies rather than recycling conventional polluting technologies that have contributed to the current state of global risk (Wexler, *et al*, 1996). For example, we suggest that pumping systems based on either the wind and solar resources be considered for the Salicornia project.

4.2.4 Initial High Cost of Technology

Projects will be attractive candidates for JI only if they present a less costly means of achieving net emissions reductions than do domestic opportunities available in the investing country (Wexler *et al.*, 1994). Although some projects may entail high technology costs it is important to examine project economics for the entire duration of the project. High technology costs today could result in lower environmental costs tomorrow.

Illumex exemplifies well the risk of using a high initial cost technology. CFLs cost between 20 to 50 times more than the incandescent lamps they replace. Most Mexican consumers would not be able to purchase the CFLs at normal retail prices and in cash. Illumex was able to mitigate the risk that sales would not ensue by offering consumers both, a significant subsidy in the price of the CFLs, and the option to buy them in installments paid through their utility bills.

Salicornia and Scolel Té did not entail the purchase of high initial cost technologies. Most forestry and land use JI projects will probably suffer less from this problem. Energy efficiency and renewable energy projects probably will as they usually depend on the introduction of high initial cost technologies.

4.2.5 *The Risk of Unintended Impacts*

Because of the newness of the activities being considered for JI (see Section 4.2.3), it is quite likely that there will be unintended impacts of the project. It will behoove project developers to establish procedures to deal with who will be responsible for assuming the extra costs such impacts entail. Alternatively, mechanisms could be set up to allocate risk responsibility to insurance companies.

In Salicornia for example, further studies of potential unintended impacts are being conducted before expansion to Phase II. It is important to ascertain that long-term cultivation will not lead to soil salinity problems or sea water intrusion, for example.

Using pilot-stages to gain more knowledge seems a good way of minimizing unexpected consequences. What still needs to be developed is an institutional infrastructure to deal with the apportionment of any such unexpected impacts among donors and recipients. Such infrastructure will probably be needed at both national and international levels.

4.3 **Institutional Issues**

4.3.1 *Absence of a Clearly Defined National Acceptance Process and Guidelines for Project Developers*

Mexico is still developing a national acceptance process and guidelines for project developers. Although a Mexican JI acceptance process was described in Section 2, all its component parts are still not complete. Long-term support of the current structure is also not ensured. Guidelines for project developers are still vague and under continual improvement.

The three projects analyzed in this paper did not suffer from the lack of an acceptance process or assessment methods for JI in Mexico. However, to qualify for JI, a project must fulfill recipient and investor country guidelines and criteria. Mexican criteria are still too vague. The clearer these are, including the stipulation of methodologies of analyses, the easier it will be for potential project promoters in Mexico to prepare acceptable proposals.

In Mexico the limited knowledge about JI among potential participants is a larger barrier to project design and implementation than the lack of a developed acceptance process. Our examination of the proposals submitted to Mexico's RV (Table 1), shows clearly a lack of understanding among project developers of what constitutes a complete JI proposal. Aside from the three case studies included in this paper, most of the other projects presented under the RV lack information that is crucial to their evaluation. Some do not define the GHG scenarios or methodology used to obtain their estimated GHG emissions reductions. Increased dissemination of the JI concept and of specific guidelines for project proposals would help project developers create proposals that fulfill JI requirements and criteria of potential recipient and investor countries.

4.3.2 Lack of Institutions to Evaluate and Monitor Projects

National institutions designated to assess, monitor, and verify JI projects are needed. Mexico's preliminary assessment team, composed of representatives from several secretariats, is evaluating projects by combining other countries' acceptance criteria and Mexico's development needs and requirements. The current institutional framework has sufficed in dealing with what have been mostly pilot and demonstration AIJ projects. However, a permanent institution is needed to deal with the challenges that JI will pose.

The Ad-Hoc Committee on JI needs to be strengthened. This will occur in the measure that there is increased interest within Mexico in JI. For the time being, the Ad-Hoc Committee serves as an overseer of projects, to ensure that these are quality projects and the terms are fair to both donor and recipient parties.

For the Scolel Té and Salicornia projects, the absence of a fully developed assessment institution was not an insurmountable obstacle. However, as the projects begin to require the monitoring and verification of carbon reductions, Mexico will need fully developed institutions to carry out or supervise these tasks. Such institutions will be particularly important once an international carbon trading system is established.

Mexico has several universities, research centers and private consultants that could evaluate and monitor carbon reduction projects, locally or nationally. These institutions would identify the types of projects they can successfully evaluate and what, if any, additional training they require.

5. CONCLUSIONS

The chief concerns that Mexico has with AIJ and JI can be summarized as either general (Table 10), or project specific concerns (Table 11). The two tables condense these concerns and either propose or describe measures to deal with them. Table 11 focuses on the projects and thus does not repeat actions proposed already in Table 10.

In conclusion, the Mexican experience with AIJ overall has been positive. It has allowed the country to create an incipient and still evolving infrastructure that in the future will be better prepared to deal with potential JI projects.

Table 10. General Mexican Concerns on AIJ/JI.

Issue of concern	Proposed solutions
Annex I countries could use JI for most of their GHG emissions reductions commitments	Annex I need to begin significant national GHG emissions reductions programs. International decision on carbon credit trading distribution between donor and recipients.
Additionality of JI funding and potential reduction of current ODA.	ODA commitments must be clear. Focus JI funding on traditionally non-ODA funded activities. Allow ODA funding only for JI system expenses and project preparation costs.
Lack of carbon emissions sharing mechanism in AIJ does not permit about this crucial aspect of JI.	Allow for proto-carbon sharing mechanisms under AIJ to obtain experience on the infrastructure needs of each.
Unknown value of carbon credits makes difficult project evaluation and complicates negotiations between donors and recipients	Let a carbon credit market determine their value or begin with national or international values (e.g., GEF's acceptable "unit abatement cost") while such a market is developed.
Mexico being an OECD country needs to keep some carbon emissions reduction options for expected future binding GHG emissions commitments. Project investors threats to go elsewhere unless given higher share of carbon credits.	Promulgate national or international guideline/standard that caps maximum foreign share of a projects' carbon credits. Prepare "high quality" projects whose soundness makes them attractive to investors. Pass and enforce international standards specifying foreign share of carbon credits.
Lack of awareness among recipients of value of carbon credits and/or weak bargaining position vis-à-vis donors.	National education campaigns on the value of carbon credits and the JI concept. National guidelines for JI project approval stipulate minimum credit sharing terms.

Table 11. Particular Issues that Surfaced in the Design, Implementation and Evaluation of AIJ Projects and Proposals in Mexico.

Issue of concern	Affected AIJ project	Proposed solutions
Difficult to estimate the incremental GHG emissions reductions.	All three projects faced this problem to a significant degree.	Sensitivity analyses and multiple scenarios. Need to update GHG emissions reductions as monitoring/evaluation data become available.
Additionality of funds	Scolec Té and Ilumex faced this issue as ODA was used for project pre-feasibility studies. In Salicornia it did not apply.	AIJ evaluators accepted Scolec Té as ODA funding not used for implementation where carbon emissions savings occur.
Skewed carbon credit sharing distribution.	Major issue in Salicornia, not applicable in Ilumex and Scolec Té.	Mexico AIJ office forced renegotiation of initial carbon credit sharing proposal.
Non-GHG benefits crucial to Mexico's interest in project and its chances of success and permanence.	Valid in all three AIJ projects. Problem was in identifying and valuing the non-GHG benefits.	Sensitivity and multiple scenario analyses. Studying potential benefits and impacts with more detail. Continuous update of project analyses as monitoring/evaluation data is available.
Newness, longer project terms, and/or dependence on the introduction of high initial cost technologies	Salicornia and Scolec Té have long project terms; Ilumex was very new and also used high cost technology.	Begin with pilot-scale projects, then phase-in larger ones. Offer consumers subsidies and financing to reduce initial cost barrier issue.

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